

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
RESEARCH AND TECHNOLOGY RESUME

## TITLE

Planetary Astronomy and Supporting Laboratory  
Research

## PERFORMING ORGANIZATION

Ames Research Center  
Moffett Field, CA 94035

## INVESTIGATOR'S NAME

Valero, F.P.J.

DESCRIPTION (a. Brief statement on strategy of investigation; b. Progress and accomplishments of prior year; c. What will be accomplished this year, as well as how and why; and d. Summary bibliography)

a. Justification: To obtain from laboratory measurements the molecular parameters needed to interpret observations of planetary and cometary spectra, and to develop the analytical and computational techniques to interpret the observed spectra in terms of planetary atmospheres including solids and cometary ices. The gas phase molecular parameters measured include the intensities and half-widths of vib-rotational lines, total intensities of absorption bands, temperature dependencies, and absorption and pressure parameters in random-band models of absorption bands.

Computation of line shapes of H<sub>2</sub> quadrupole lines from quantum mechanical first principles for comparison with laboratory data and use in modeling of planetary atmospheres. The solid phase measurements include band profile and quantitative intensity measurements and dependence on composition as well as thermal and photolytic processing which mimic the particular astrophysical environments.

b. Accomplishments: Work on GeH<sub>4</sub>, PH<sub>3</sub>, CH<sub>3</sub>D have made significant progress. A paper on the GeH<sub>4</sub> results has been submitted for publication and results on CO<sub>2</sub>, PH<sub>3</sub> and CH<sub>3</sub>D will be reported at the Prague Spectroscopy Conference in September 1988. In the laboratory numerous spectra of CH<sub>3</sub>D, CO<sub>2</sub>, GeH<sub>4</sub> have been obtained and the required safety measures for levelling of PH<sub>3</sub> are being implemented.

c. Plans: The spectra of PH<sub>3</sub> will be obtained and work on CH<sub>3</sub>D and GeH<sub>4</sub> will be extended. The modeling effort on Titan's Spectrum will continue in the 1.1 to 2.6 um region.

d. Publications: "Determination of A<sub>0</sub> for CH<sub>3</sub>D from Perturbation-Allowed Transitions" C. Chackerian et al. Jour. Mol. Spect. 117, 355, 1986. "Absolute Line Strengths of PH<sub>3</sub> Gas near 5/um" R.W. Lovejoy et al. 109, 246 (1985). "Intensity Measurements of Individual Lines and Manifolds in the Spectrum of the 5 Micron Fundamental Band of Germane" L.P. Giver and C. Chackerian, (submitted) preparation. Line lists on tapes: (include E, Nu and S). Nu<sub>3</sub> Band CH<sub>3</sub>D atmos. Geisa, AFGL-Several CO<sub>2</sub> bands AFGL. "Foreign Gas Collision Broadening of the Far Infrared Spectrum of Water Vapor" S.D. Gasster, C.H. Townes, D. Goorvitch and F.P.J. Valero. Jour Opt. Soc. Am. B,

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